SAMARJITH BISWAS, Ph.D.

Research Scientist III, NSF NewFoS Center, University of Arizona

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PROFILE

Mechanical and aerospace engineer (Ph.D.) working in acoustics, vibration and wave physics: phononic crystals and acoustic metamaterials, topological acoustics, surface-acoustic-wave devices, thermoacoustics and acoustic liners, and physics-informed machine-learning surrogates that replace hours of finite element solving with millisecond predictions. Builds models in COMSOL and ANSYS and checks them against instrumented measurement. Research scientist at the NSF New Frontiers of Sound (NewFoS) Science and Technology Center, a $30M centre spanning nine universities. Doctoral work on thermoacoustic liners with NASA Langley Research Center, and an international (PCT) patent application on thermoacoustic metastructures. M.S. work on structural composites that carry load and store energy, 53.58 mWh/kg with a 6.9 GPa flexural modulus. Four peer-reviewed journal articles and two peer-reviewed conference papers.

EDUCATION

Doctor of Philosophy (Ph.D.) in Mechanical & Aerospace Engineering — 2019 – 2024
Oklahoma State University — Stillwater, OK

Master of Science (M.S.) in Mechanical Engineering — 2017 – 2019
Northern Arizona University — Flagstaff, AZ

Bachelor of Science (B.S.) in Mechanical Engineering — 2011 – 2016
Rajshahi University of Engineering & Technology (RUET) — Bangladesh

PROFESSIONAL EXPERIENCE

Research Scientist III, AI and Acoustic Engineering — Sep 2024 – Present
NSF Center for New Frontiers of Sound (NewFoS), University of Arizona — Tucson, AZ

- **PhononIQ.** Designed and deployed a browser-based deep-learning surrogate that turns 1–3 hour COMSOL eigenfrequency solves into in-browser predictions in under 5 ms, at R^2 of about 0.98. Models include a 2D physics-informed CNN (about 2 M parameters), a 3D voxel-input CNN with squeeze-and-excitation blocks and a PCA-projection head (about 808 K parameters), and a gradient-descent inverse-design loop that runs through the trained surrogate.
- **Physics-informed training.** Added loss terms for band ordering, the acoustic zero at the Brillouin-zone centre, non-negative frequencies and smoothness along the wavevector path, which cut unphysical predictions by 57% against an unconstrained baseline.
- **Topological acoustics.** Lead author on directional propagation of interface modes through spin-momentum locking in a topological acoustic metamaterial (Scientific Reports, 2026), with A. Alù and M. Leamy.
- **Phononic crystal plates.** Finite element and machine-learning design of phononic crystal plates in borosilicate glass, laser-drilled with AdValue Photonics and measured by vibration transmission. On one plate both measured band edges fell within 2% of the finite element prediction; on the second the upper edge matched and the lower edge was rounded off by the finite plate size.
- **Surface-acoustic-wave devices.** Co-author on composite superlattice radio-frequency SAW devices (Physical Review Applied, 2026).
- **Supervision.** Co-supervise graduate researchers at Oklahoma State University, the University of Arizona and Wayne State University on machine-learning surrogate modelling and acoustic device design.

Graduate Research Associate, Thermoacoustic Systems — Aug 2019 – Aug 2024
Oklahoma State University, Mechanical & Aerospace Engineering — Stillwater, OK

- **Thermoacoustic metastructures.** Developed thermoacoustic metastructures (TAMS) for noise reduction and energy harvesting; 5.28 dB drop at 117.5 Hz and about 33 mV from a thermopile on the bench. Subject of PCT application WO 2025/128348 A1.
- **NASA Langley.** Designed thermoacoustic liner test articles and test matrices for NASA Langley's normal-incidence and grazing-flow impedance tubes (to Mach 0.5) and analysed the results (Int. J. Aeroacoustics). Peak stack temperature gradient of 9.5 °C at 790 Hz under 140 dB tones in normal incidence.
- **Lab manager.** As lab manager of the Solid and Structural Dynamics Lab at Oklahoma State (2021–2024), managed a $300K+ vibration and acoustic test facility.
- **Additively manufactured stacks.** Designed printed thermoacoustic stacks as an alternative to ceramic honeycomb, with pore width and wall thickness chosen from Rott's approximation.
- **Modelling and measurement.** Modelled thermoacoustic devices in COMSOL Multiphysics, ANSYS and DeltaEC, with parametric studies over stack length, stack position and resonator geometry; measured temperature fields, sound pressure, acoustic absorption and thermopile output.
- **Mentoring.** Mentored 5 undergraduate and 2 graduate students in experimental technique and computational modelling.

Instructor and Graduate Teaching Associate, Mechanical & Aerospace Engineering Aug 2019 – Aug 2023
Oklahoma State University Stillwater, OK

- **Instructor of Record**, Machine Elements (4000 level, 60–80 students per semester); developed MATLAB and SolidWorks lab modules; taught in the Summer Bridge Program for 30–40 incoming engineering students.
- **Graduate Teaching Associate**, Engineering Dynamics, including Honors sections on advanced dynamics and mathematical modelling.

Graduate Research Assistant, Energy Storage Systems Aug 2017 – Jul 2019
Northern Arizona University, Mechanical Engineering Flagstaff, AZ

- **M.S. thesis, structural power-storage composite.** Structural supercapacitor laminates, planar and L-shaped, reaching 53.58 mWh/kg energy density and 32.06 W/kg power density at 2 V, with a 6.9 GPa flexural modulus and 59.47 MPa flexural strength.
- Electrode functionalisation gave a specific capacitance of up to 57.82 mF/g.
- Electrochemical testing (cyclic voltammetry, electrochemical impedance spectroscopy, galvanostatic cycling) and mechanical testing (tensile, flexural, fatigue).

Research & Development Engineer Apr 2017 – Aug 2017
B-Trac Engineering Ltd Dhaka, Bangladesh

- Designed mobile surveillance watchtower systems for the Bangladesh Police, including the hydraulic elevation system, power distribution and communications integration; supervised a team of eight engineers and technicians.

PUBLICATIONS

Peer-reviewed journal articles.

- **Biswas, S.**; Najmi, F.; Lucas, P.; Deymier, P. A.; Runge, K.; Alù, A.; Leamy, M.; Muralidharan, K. Directional Propagation of Interface Modes in Topological Acoustic Metamaterials via Spin-Momentum Locking. Scientific Reports (2026). doi:10.1038/s41598-026-62783-x.
- Najmi, F.; Yawit, H.; Takeda, W.; Basu, A.; **Biswas, S.**; Mutlu, Z.; Lucas, P.; Muralidharan, K.; Alù, A.; et al. Composite Superlattice Radio-Frequency Surface-Acoustic-Wave Devices. Physical Review Applied 25, 054035 (2026). doi:10.1103/p8q7-r6ck.
- **Biswas, S.**; Krawczyk, Z.; Manimala, J. M. Multifunctional Characterization of a Thermoacoustic Meta-Structure. Progress in Engineering Science 2, 100147 (2025). doi:10.1016/j.pes.2025.100147.
- **Biswas, S.**; Kresl, W.; Manimala, J. M. On the Relationship Between Acoustic Absorption and Temperature Gradient in a Thermoacoustic Liner. International Journal of Aeroacoustics 24(1–2), 42–67 (2025). doi:10.1177/1475472X241306317.

Peer-reviewed conference papers.

- **Biswas, S.**; Manimala, J. M. Exploring the Feasibility of a Thermoacoustic Metastructure for Energy Harvesting and Noise Mitigation. Proceedings of Meetings on Acoustics 49, 030003 (2022). doi:10.1121/2.0001670.
- **Biswas, S.**; Krawczyk, Z.; Manimala, J. M. Evaluation of Additively Manufactured Stacks for Thermo-Acoustic Devices. INTER-NOISE and NOISE-CON Congress and Conference Proceedings 263(2), 4376–4387 (2021). doi:10.3397/IN-2021-2683.

Manuscripts under review or in revision.

- Singh, K.; **Biswas, S.**; Takeda, W.; Deymier, P. A.; Runge, K.; Zhang, H. H.; Lucas, P.; Muralidharan, K. Multi-Model Machine-Learning Surrogate for Bandgap Prediction of a 2D Hexagonal Phononic Crystal Plate with Experimental Validation. Journal of Sound and Vibration, revision submitted.
- Takeda, W.; **Biswas, S.**; Wang, Q.; Jiang, S.; Deymier, P. A.; Lucas, P. Laser Micromachining of Phononic Crystals and Waveguides in Borosilicate Glass. Journal of Applied Physics, under revision.
- **Biswas, S.**; Snyder, M.; Manimala, J. M. Metamaterial-Inspired Stack Architectures for Broadband Thermoacoustic Energy Conversion. Applied Acoustics, under revision.
- **Biswas, S.**; Singh, K.; Deymier, P. A.; Runge, K.; Lucas, P.; Zhang, H. H.; Muralidharan, K. Physics-Informed Convolutional Neural Network for the Full Elastic Dispersion of Honeycomb Phononic Plates. Manuscript in revision.

PATENT APPLICATIONS

International patent application (PCT) WO 2025/128348 A1, published June 2025, pending; **Biswas, S.**; Manimala, J. M. Thermoacoustic metastructure for energy harvesting and noise mitigation.

PRESENTATIONS

- Machine Learning-Accelerated Design of Phononic Crystals: From Optimized Experimental Design Through Simulation to Experimental Validation. 190th Meeting of the Acoustical Society of America, Philadelphia, PA, May 2026 (talk, session 3aEA).
- Physics-Informed Convolutional Neural Network for the Full Elastic Dispersion of Honeycomb Phononic Plates. ASA School 2026, Acoustical Society of America (poster, presenting author).
- Quiet Power: Exploring the Feasibility of a Noise-Mitigating Thermoacoustic Energy Harvester. 182nd Meeting of the Acoustical Society of America, Denver, CO, May 2022 (abstract in J. Acoust. Soc. Am. 151(4), A179).
- Quiet Power: Exploring the Feasibility of Thermoacoustic Energy Harvesting. 4th Annual MAE Graduate Research Symposium, Oklahoma State University, 2022 (Best Oral Presentation Award).
- Evaluation of Additively Manufactured Stacks for Thermo-Acoustic Devices. INTER-NOISE 2021, Washington, D.C., August 2021.

SKILLS & METHODS

Acoustics & wave physics. Acoustic metamaterials and metasurfaces; phononic crystals; topological acoustics and spin-momentum-locked interface modes; surface-acoustic-wave devices and transducers; thermoacoustics; elastic and acoustic wave propagation, dispersion, band structure and resonance; Bloch-Floquet eigenvalue analysis; noise control and absorption.

CFD & aeroacoustics. ANSYS CFD for external flow and airfoils; lattice Boltzmann simulation (FluidX3D); aeroacoustics of acoustic liners, impedance testing under grazing flow to Mach 0.5.

Structural dynamics & FEA. Modal, harmonic, random-vibration, transient and coupled thermal-structural analysis; vibro-acoustic modelling; COMSOL Multiphysics (advanced); ANSYS Workbench and Mechanical; DeltaEC; simulation-to-test correlation with the Modal Assurance Criterion.

Resonant devices. Piezoelectric surface-acoustic-wave device modelling; interdigital transducers; Mason equivalent-circuit and transfer-matrix models.

Machine learning. PyTorch, TensorFlow, ONNX; physics-informed neural networks; 2D and 3D convolutional networks; CNN and MLP fusion; squeeze-and-excitation blocks; gradient-descent inverse design; PCA target reparameterisation; Latin-hypercube design of experiments.

Experimental methods. Anechoic and reverberation chamber testing; normal-incidence impedance tube; laser-Doppler vibrometry; shakers, impact hammers and accelerometers; acoustic intensity mapping; NI-DAQ and LabVIEW; measurement-uncertainty and sensor-placement analysis; test plans.

Software & CAD. Python (NumPy, SciPy, Pandas, scikit-learn, Plotly); MATLAB and Simulink; JavaScript with ONNX Runtime Web (WebAssembly); C/C++; SolidWorks with GD&T to ASME Y14.5; Git; Linux; LaTeX.

AWARDS & RECOGNITION

- ASA School selectee, Acoustical Society of America (2025 and 2026).
- Best Oral Presentation Award, OSU MAE Graduate Research Symposium (2022).
- International Excellence Award, Northern Arizona University (2018–2019).
- Finalist, 3-Minute Teach Competition (2023) and Riata Center Business Plan Competition (2022); Dean's List, RUET (2014–2016).

SERVICE, CREDENTIALS & AFFILIATIONS

- **Peer reviewer.** Nature Communications (2026); International Journal of Mechanical Sciences (2023–present); Journal of Sound and Vibration (2022–present).
- **Judge.** OSU MAE Graduate Research Symposium (2024); Oklahoma State Science and Engineering Fair (2023); 27th Annual OK-LSAMP Research Symposium (2023).
- **Certifications.** Six Sigma Green Belt (2023); Engineering Project Management Specialization (2023).
- **Membership.** Acoustical Society of America (2021–present); Engineering Acoustics and Structural Acoustics & Vibration technical committees.

Languages: English (fluent) | Bengali (native) | Hindi (conversational) · Last updated October 2026